Tropical Biodiversity 2(1): 270 (1994)

RESEARCH NOTE

HAS THE DIVERSITY OF TROPICAL ANT FAUNA BEEN UNDERESTIMATED? AN INDICATION FROM LEAF LITTER STUDIES IN A WEST MALAYSIAN LOWLAND RAIN FOREST

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ABSTRACT

Species diversity, especially in tropical areas, has been incompletely studied. Estimations are very often not based on actual field work, and certain sampling methods can overlook or underestimate groups of species. In this brief paper, we present an indication that current ant species diversity may be underestimated or species compostion skewed due to sampling that ignores leaf litter.

Key words: ants; leaf litter; species diversity; Winkler/Moczarski apparatus

Received: 17 December 1993; Accepted: 28 May 1994.

INTRODUCTION

The amount of insect diversity in the world has long been a point of debate among scientists. In a recent paper, Gaston (1990) proposed a corrected figure to Erwin's (1982;1988) estimates of the world's number of insect species. In a response to this correction, Erwin (1991) stressed that Gaston's figures were suspect and that such estimates by experts lacking field experience were flawed from a lack of hands-on experience. This complaint could also apply to the lack of knowledge many taxonomists have on the diversity of fauna habitats and the different habitat strata available to insects. One prime example of a neglected stratum is the leaf litter found on the floor of tropical rain forests.

A reading of the publications on ant biodiversity (see Holldobler and Wilson, 1990, for references) shows that estimates of the number of ant species are based mainly on ants living in the canopy or above ground; ants from these strata can be collected quite easily, either by hand or by fogging or both. This habitat bias is indicated by the dominance in such studies of genera such as *Camponotus, Dolichoderus,* and *Crematogaster*, which are almost always aboricolous.

Specialized leaf litter and soil insects have only rarely been given adequate attention (e.g. Hammond, 1990). This might be due to the fact that animals of the leaf litter are extremely small and are not very attractive in terms of form and coloration. In addition, no methods for direct specimen extraction exist--one must usually wait a full day to obtain specimens from a sample. All of these hindrances may have contributed to a neglect of the leaf litter stratum as a source of species diversity.

MATERIALS AND METHODS

The samples on which this study is based were collected during a visit to the University of Malaya's field station in Ulu Gombak, Selangor, West Malaysia. The samples were collected at the end of the rainy season (September, 1991) during a dry day, and a Winkler/Moczarski extraction system was used. For a description and discussion of the Winkler/Moczarski apparatus, see Besuchet *et al.* (1987).

The station is situated in a reserve of secondary lowland rain forest on alluvial sandy soil. The understory consists of a shrub layer which is widely spaced. The leaf litter layer on the forest floor is homogenous and there is a 1-3 cm thick layer of rotting logs and leaves at the bases of tree buttresses and bamboo stands.

For Sample A, an 8 m^2 area was chosen which was homogenous in the litter covering the soil--it was free of rotting twigs, logs, and leaf litter other than the soil coverage. The soil sample was sifted to fill five inlet bags for the Winkler/Moczarski apparatus.

Sample B was chosen to specifically include leaf litter habitats. Included in this sample were rotting leaves infested by fungal mycorrhiza (recognized by their white mycelia), rotting twigs, rotting logs, and the litter found below the logs. This sample covered an area of approximately 20 m^2, or the amount of 20 inlets of the Winkler/Moczarski apparatus (5 Winkler bags).

RESULTS AND DISCUSSION

The species of ants found in Samples A and B are listed in Table 1. The overall total number of species was 37 in sample A and 104 in Sample B. If

one assumes a linear relationship between plot area and species diversity (by no means a certainty), Sample A would contain 90 species if it was as big as Sample B. This indicates that the number of ant leaf litter fauna may be higher if sampling involving mixed leaf litter is used. However, due to sampling size and the unequal area of the test plots, it would be very premature to draw such conclusions at this time.

What is more substantive from this data is the nature of the ant species obtained from the two samples. The species obtained from Sample B (mixed leaf litter) are dominant in Ponerini (*Pachycondyla, Hypoponera,* and *Ponera*) and Dactonini (*Smithistruma* and *Strumigenys*); these represent mainly species of subterranean and ground ants. This is in contrast to Sample A and a noted study by Wilson (1987), both of which found ant samples dominated by *Camponotus, Dolichoderus,* and *Crematogaster*, genera with mainly arboricolous species.

This point is emphasized by comparisons to lists from Wilson (1959) and Rosciszewski (unpubl.) which together inventory over one square mile of Oriental forest. Their inventories contain fewer species and even fewer genera of Ponerini and Dacetonini than was found in our very restricted sampling area.

This preliminary study indicates that the biodiversity of ant fauna in given areas may have been underestimated or species make-up seriously skewed due to a lack of attention to the leaf litter stratum.

Table 1. Species collected in two different-sized samples of rain forest leaf litter. Sample A (covering 8 m^2) contained only homogenous leaf litter. Sample B (covering 20 m^2) contained mixed leaf litter, plant debris, and rotting logs.

	SPECIES	**SAMPLE A**	**SAMPLE B**
	Subfamily: Cerapachyinae		
1	*Cerapaychys* sp. 1		x
	Cerapaychys sp. 2		x
	Cerapaychys sp. 3		x
	Subfamily: Aenictinae		
2	*Aenictus* sp. 1		x
	Subfamily: Ponerinae		
3	*Anochetus* sp. 1		x
	Anochetus sp. 2		x
	Anochetus sp. 3		x
	Anochetus sp. 4		x
	Anochetus sp. 5		x
4	*Belonopelta* sp. 1		x
5	*Centromyrmex* sp. 1	x	x
6	*Gnamptogenys* sp. 1		x
	Gnamptogenys sp. 2	x	
	Gnamptogenys sp. 3	x	x
	Gnamptogenys sp. 4		x
	Gnamptogenys sp. 5		x

Table 1 (continued)

	SPECIES	SAMPLE A	SAMPLE B
7	*Hypoponera* sp. 1		x
	Hypoponera sp. 2		x
	Hypoponera sp. 3		x
	Hypoponera sp. 4		x
	Hypoponera sp. 5	x	x
8	*Leptogenys* sp. 1		x
	Leptogenys sp. 2	x	x
	L. processionalis gp. sp. 3		x
9	*Mystrium camillae*		x
10	*Odontomachus* sp. 1		x
	Odontoponera sp. 1	x	x
11	*Ponera* sp. 1	x	x
	Ponera sp. 2	x	x
	Ponera sp. 3	x	x
12	*Probolomyrmex* sp. 1		x
13	*Pachycondyla* sp. 1		x
	Pachycondyla sp. 2	x	x
	Pachycondyla sp. 3	x	x
	Pachycondyla sp. 4	x	x
	Pachycondyla sp. 5		x
	Pachycondyla sp. 6	x	x
	Pachycondyla sp. 7		x
	Pachycondyla sp. 8		x
	Pachycondyla sp. 9		x
	Pachycondyla sp. 10		x
	Pachycondyla sp. 11		x
	Pachycondyla sp. 12		x
14	*Proceratium* sp. 1	x	x
	Proceratium sp. 2		x
	Proceratium sp. 3		x
	Proceratium sp. 4		x
	Proceratium sp. 5		x
	Proceratium sp. 6	x	x
Subfamily: Dolichonderinae			
15	*Dolichoderus* sp. 1		x
16	*Tapinoma* sp. 1		x
Subfamily: Formicinae			
17	*Formicinae* sp. 1		x
18	*Formicinae* sp. 2		x
19	*Acropyga* sp. 1		x
20	*Euprenolepis* sp. 1		x
	Euprenolepis sp. 2		x
21	*Myrmoteras* sp. 1		x
	Myrmoteras sp. 2		x
22	*Paratrechina* sp. 1		x
23	*Prenolepis* sp. 1		x
Subfamily: Myrmicinae			
24	*Myrmicinae* genus 1 sp. 1		x
25	*Myrmicinae* genus 2 sp. 1	x	x
26	*Myrmicinae* genus 3 sp. 1		x
27	*Myrmicinae* genus 4 sp. 1		x
28	*Myrmicinae* genus 5 sp. 1		x
29	*Myrmicinae* genus 6 sp. 1		x

Table 1 (continued)

	SPECIES	SAMPLE A	SAMPLE B
30	*Myrmicinae* genus 7 sp. 1		x
31	*Acanthomyrmex* sp. 1		x
	Acanthomyrmex sp. 2		x
32	*Crematogaster* sp. 1		x
	Crematogaster sp. 2		x
33	*Glamtyromyrmex* sp. 1		x
34	*Lordomyrma?* sp. 1		x
35	*Myrmecina* sp. 1		
	Myrmecina sp. 2		
	Myrmecina sp. 3		x
	Myrmecina sp. 4		
	Myrmecina sp. 5		
	Myrmecina sp. 6		
36	*Oligomyrmex* sp. 1		x
	Oligomyrmex sp. 2		x
	Oligomyrmex? sp. 2		x
37	*Pheidole* sp. 1	x	x
	Pheidole sp. 2		x
	Pheidole sp. 3		x
	Pheidole sp. 4		x
	Pheidole sp. 5		x
	Pheidole sp. 6		x
	Pheidole sp. 7		x
	Pheidole sp. 8		x
	Pheidole sp. 9		x
	Pheidole sp. 10		x
	Pheidole sp. 11		x
	Pheidole sp. 12		x
	Pheidole sp. 13		x
38	*Pheidologeton* sp. 1		x
	Pheidologeton sp. 2		x
39	*Pristomyrmex* sp. 1		x
	Pristomyrmex sp. 2	x	x
40	*Proatta* sp. 1		x
41	*Smithistruma* sp. 1	x	x
	Smithistruma sp. 2		x
	Strumigenys sp. 1		x
	Strumigenys sp. 2		x
	Strumigenys sp. 3	x	x
	Strumigenys sp. 4	x	x
	Strumigenys sp. 5		x
42	*Tetramorium* sp. 1	x	x
43	*Tetramorium* sp. 2	x	x

ACKNOWLEDGEMENTS

We thank the University of Malaya for the permission to use the Ulu Gombak field station. Andy Plaszek, Neil Springate, and Krysztof Rosciszewski helped to improve the manuscript. The financial assistance of the Malaysian government through research grant IRPA 4-07-03-07 is also acknowledged.

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